CLAIMS

The following is a detailed listing of all claims that are, or were, in the Application.

1-15. (Cancelled)

16. (Previously presented) A system for driving a plurality of light emitting diodes (LEDs) comprising:

a voltage regulator operable to provide current to the plurality of LEDs;

a plurality of current regulators, each current regulator connected to a respective LED and operable to regulate the current provided to the respective LED; and

a detector coupled to the plurality of current regulators, the detector operable to detect an occurrence of current starvation at any of the current regulators, the detector further operable to output a signal for adjusting power supplied to the charge pump in response to the detection of an occurrence of current starvation.

17. (Previously presented) The system of claim 16 wherein the charge pump has at least two operating modes, each operating mode having a respective voltage gain, and wherein one of the at least two operating modes is selected in response to the detection of an occurrence of current starvation.

18. (Previously presented) The system of claim 17 further comprising a mode latch operable to control selection of an active operating mode from the at least two operating modes.

19. (Previously presented) The system of claim 16 wherein the detector receives a reference voltage and comprises a comparator operable to compare the reference voltage to a voltage derived from one or more of the LEDs.

20. (Previously presented) The system of claim 16 wherein the detector comprises a wired-OR circuit arrangement.

21. (Previously presented) The system of claim 16 wherein the detector comprises a temperature compensating diode.

22. (Previously presented) The system of claim 16 wherein the detector comprises a plurality of bipolar diodes, each bipolar diode connected to a respective one of the LEDs.

23. (Previously presented) The system of claim 16 wherein each current regulator comprises a respective field effect transistor.

24. (Previously presented) The system of claim 16 wherein the system is implemented entirely on a single, semiconductor die.

25. (Previously presented) The system of claim 16 wherein the voltage regulator comprises a charge pump.

26. (Previously presented) A method for driving a plurality of light emitting diodes (LEDs) comprising:

providing current to the plurality of LEDs using a voltage regulator;

regulating the current provided to each LED with a respective current regulator;

detecting an occurrence of current starvation at any of the current regulators; and

adjusting power supplied to the charge pump in response to the detection of an occurrence of current starvation.

27. (Previously presented) The method of claim 26 wherein the voltage regulator has at least two operating modes, each operating mode having a respective voltage gain, wherein the method comprises selecting one of the at least two operating modes in response to the detection of an occurrence of current starvation.

28. (Previously presented) The method of claim 27 comprising controlling the selection of an active operating mode from the at least two operating modes.

29. (Previously presented) A circuit for providing current to a plurality of light emitting diodes (LEDs), the circuit comprising:

a charge pump terminal operable to supply current to the plurality of LEDs;

a voltage regulator operable to supply energy to the charge pump;

a plurality of current regulators, each current regulator operable to control current in a respective one of the LEDs; and

a detector operable to detect a condition of current starvation at any of the current regulators;

wherein the voltage regulator has an output that is responsive to detection of the condition of current starvation.

30. (Previously presented) The circuit of claim 29 wherein the charge pump has at least two operating modes, each operating mode having a respective voltage gain, and wherein one of the at least two operating modes is selected in response to detection of the condition of current starvation.

31. (Previously presented) The circuit of claim 30 further comprising a mode latch operable to control selection of an active operating mode from the at least two operating modes.

32. (Previously presented) The circuit of claim 29 wherein the detector comprises a wired-OR circuit arrangement.

33. (Previously presented) The circuit of claim 29 wherein the detector comprises a plurality of bipolar diodes and each current regulator comprises a respective field effect transistor.

34. (Previously presented) A system for driving a plurality of light emitting diodes (LEDs) comprising:

a charge pump operable to provide current to the plurality of LEDs;

a detector coupled to the plurality of LEDs, the detector operable to detect an undervoltage condition at any of the LEDs, the detector further operable to output a signal for adjusting power supplied to the charge pump in response to the detection of the undervoltage condition; and

a plurality of current regulators, each current regulator connected to a respective LED and operable to regulate the current provided to the respective LED so that, collectively, the plurality of LEDs are uniformly illuminated.

35. (Previously presented) The system of claim 34 wherein the charge pump comprises a multi-mode charge pump operable to function in a plurality of operating modes, each mode operating mode having a respective voltage gain.

36. (Previously presented) The system of claim 35 further comprising a mode latch operable to store information for selecting one of the plurality of operating modes.

37. (Previously presented) The system of claim 34 wherein the detector receives a reference voltage and comprises a comparator operable to compare the reference voltage to a voltage derived from one or more of the LEDs.

38. (Previously presented) The system of claim 34 wherein the detector comprises a wired-OR circuit arrangement.

39. (Previously presented) The system of claim 34 wherein the detector comprises a plurality of bipolar diodes, each bipolar diode connected to a respective one of the LEDs.

40. (Previously presented) The system of claim 34 wherein the system is implemented entirely on a single, semiconductor die.

41. (Previously presented) A method for driving a plurality of light emitting diodes (LEDs) comprising:

providing current to the plurality of LEDs using a charge pump;

regulating the current provided to each LED so that, collectively, the plurality of LEDs are uniformly illuminated;

detecting an undervoltage condition at any of the LEDs; and

adjusting power supplied to the charge pump in response to the detection of the undervoltage condition.

42. (Previously presented) The method of claim 41 wherein the charge pump has at least two operating modes, each operating mode having a respective voltage gain.

43. (Previously presented) The method of claim 42 wherein adjusting comprises selecting one of the at least two operating modes in response to the detection of an undervoltage condition.

44. (Previously presented) A system for providing power to a plurality of light emitting diodes (LEDs) comprising:

a multi-mode charge pump operable to provide voltage to the LEDs at a plurality of gain ratios;

a detector for detecting if a supply voltage for the system is diminishing and for adjusting the gain ratio of the multi-mode charge pump in response to the detection of a diminishing supply voltage; and

a plurality of current regulators, each current regulator coupled to one of the plurality of LEDs for individually adjusting the power supplied to the respective LED.

45. (Previously presented) The system of claim 44 wherein the detector comprises a comparator for comparing the supply voltage against a reference voltage.

46. (Previously presented) A method for providing current to a plurality of light emitting diodes (LEDs) comprising:

regulating current in each of the LEDs to not exceed a desired amount;

detecting a condition of current starvation in any of the LEDs; and

regulating a voltage supplied to the plurality of LEDs in response to the detecting so that the current starvation is abated.

47. (Previously presented) The method of claim 46 wherein the regulating a voltage is performed using a multi-mode charge pump.

48. (Previously presented) The method of claim 46 wherein the regulating a voltage is performed using a linear voltage regulator.

49. (Previously presented) A system for providing current to a plurality of light emitting diodes (LEDs) comprising:

means for regulating current in each of the LEDs to not exceed a desired amount;

means for detecting a condition of current starvation in any of the LEDs; and

means for regulating a voltage supplied to the plurality of LEDs in response to the detecting so that the current starvation is abated.

50. (Previously presented) The system of claim 49 wherein the means for regulating a voltage comprises a multi-mode charge pump.

51. (Previously presented) The system of claim 49 wherein the means for regulating a voltage comprises a linear voltage regulator.

52. (Previously presented) A detector for regulating power provided to a plurality of light emitting diodes (LEDs) comprising:

a plurality of diodes, each diode connected to a respective LED at a respective sense terminal, wherein the plurality of diodes operate collectively to provide a signal derived from a lowest of voltage values appearing at the sense terminals; and

an operational amplifier operable to receive the signal provided by the plurality of diodes, the operational amplifier operable to generate a feedback signal for controlling the power supplied to the plurality of LEDs so that the voltage values appearing at the sense terminals are held at an appropriate level.

53. (Previously presented) The detector of claim 52 wherein each diode comprises a bipolar diode.

54. (Previously presented) The detector of claim 52 wherein operational amplifier compares the signal provided by the plurality of diodes against a reference signal.

55. (Previously presented) The detector of claim 52 wherein the plurality of diodes function as an OR gate.

56. (Previously presented) A method for efficiently powering a plurality of light emitting diodes (LEDs) comprising:

supplying a voltage for the LEDs, wherein the voltage causes current to flow through each of the LEDs;

regulating the current in each of the LEDs to not exceed a respective predetermined amount so that the LEDs are uniformly illuminated;

detecting if any one of the LEDs is receiving insufficient current; and

in response to the detection of insufficient current, adjusting the voltage supplied to the LEDs so that no LED is receiving insufficient current.